

A new species of *Baryscapus* (Hymenoptera Chalcidoidea Eulophidae), a parasitoid of *Henosepilachna elaterii* (Coleoptera Coccinellidae), with notes on its biology

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Abstract

A new species of *Baryscapus* Foerster is described. *Baryscapus ecbalii* sp. n. was reared from puparia of *Henosepilachna elaterii* (Coleoptera Coccinellidae). This ladybird beetle is often a pest of economically important cucurbitaceous plants. Some biological observations on the new species are also provided.

Key words: Hymenoptera, Chalcidoidea, Eulophidae, Malta, *Baryscapus*, new species.

Introduction

The Eulophidae is a large family within the superfamily Chalcidoidea (Hymenoptera) with over 6,050 described species worldwide (Noyes, 2016) of which about 1,100 occur in Europe (Gauld and Bolton, 1988). The Eulophidae fauna of the Maltese Islands is still very poorly known with only 35 species recorded to date (Mifsud, 2012; Askew and Mifsud, 2016). Species in this family display a varied biology; species parasitize hosts in more than 100 families, spread over a total of ten insect orders, sometimes also attacking spider eggs, as well as mites and nematodes which induce plant galls (La Salle, 1994).

In July 2015 several specimens of a hymenopteran parasitoid were reared from pupae of the melon ladybird beetle, *Henosepilachna elaterii* (Rossi). This eulophid parasitoid, which belongs to the subfamily Tetrastichinae and is accommodated in the genus *Baryscapus* Foerster, proved to be a new species to science and is described below. The genus *Baryscapus* currently accommodates 122 described species (Noyes, 2016) but many more undoubtedly await discovery. Ribes (2014) for example recently described two new species from Spain. The genus has a cosmopolitan distribution with around 60 species known in Europe and the Mediterranean Region. *Baryscapus* species are characterized mainly by having a black body often with metallic reflections, with no pale markings, submarginal vein with 2 or more dorsal setae, gaster with cercal setae short and subequal in length, malar sulcus distinctly curved, and propodeal spiracles wholly exposed, not covered by a flap of the callus. Hosts include species in the following insect orders: Lepidoptera, Coleoptera, Hymenoptera, Diptera, rarely Hemiptera and Neuroptera. Whilst monophagy is rare, most species of *Baryscapus* have a primary host range restricted to one or a few related host families. All species are endophagous. In hosts of relatively large size, gregarious parasitism is very common, and secondary parasitism is also common amongst species in this genus. It is rather uncertain to what degree the host progresses in its life cycle following parasitiza-

tion by some species; some species could be either idio-biont parasitoids or behave as koinobionts for only a brief period (Askew and Shaw, 2005).

Materials and methods

All of our specimens of the new species of *Baryscapus* were reared from pupae of *H. elaterii*. The beetle pupae were always collected from *Ecballium elaterium* near agricultural fields and each was kept alive in a separate plastic container until possible emergence of parasitoids took place. The plastic containers were regularly checked for condensation and possible fungal growth and if this was detected, the container was immediately replaced. Emerged specimens were kept alive for 2-4 days and after this they were either killed with ethyl acetate, or placed directly in ethanol. Specimens in ethanol were dried using hexamethyldisilazane (HMDS), and mounted on cards. Some specimens were dissected and mounted on microscope slides for detailed observation using a compound microscope, Leica DM 3000 and relevant photographs were done using a mounted Leica ICC50W digital camera on the mentioned microscope. Some dry mounted specimens were carbon coated and examined with a Zeiss GeminiSEM - field emission scanning electron microscope.

Morphological terms used in the species' description follow those of Graham (1991). Where relevant, variability of the different morphological structures mentioned in the description below was based on measurements/observations made on 9 females (the holotype and 8 paratypes) and 3 males (paratypes).

Baryscapus ecbalii sp. nov.

Female

Body length 1.7-2.0 mm. Body black with strong metallic blue-green tints. Head with a transverse yellow sutural line below anterior ocellus and a yellowish

streak from each torulus to dorsolateral corners of the clypeus; antenna (figure 1a) brown with scape and pedicel yellowish ventrally; thorax (figure 1b) with yellowish linear sutures at inner edge and anterior angle of axilla, and dorsal and posterior edges of prepectus, yellowish marks on meso- and metapleuron about wing insertions and a yellowish non-metallic spot on each side of

the dorsellum; tegula black, wings clear with testaceous venation and no decolourized spot between parastigma and marginal vein; legs with all coxae and femora dark metallic green, the femora pale yellow on about their apical thirds, tibiae and meso- and metatarsi pale yellow, all protarsus and fourth tarsal segments and claws of other tarsi more or less darkened.

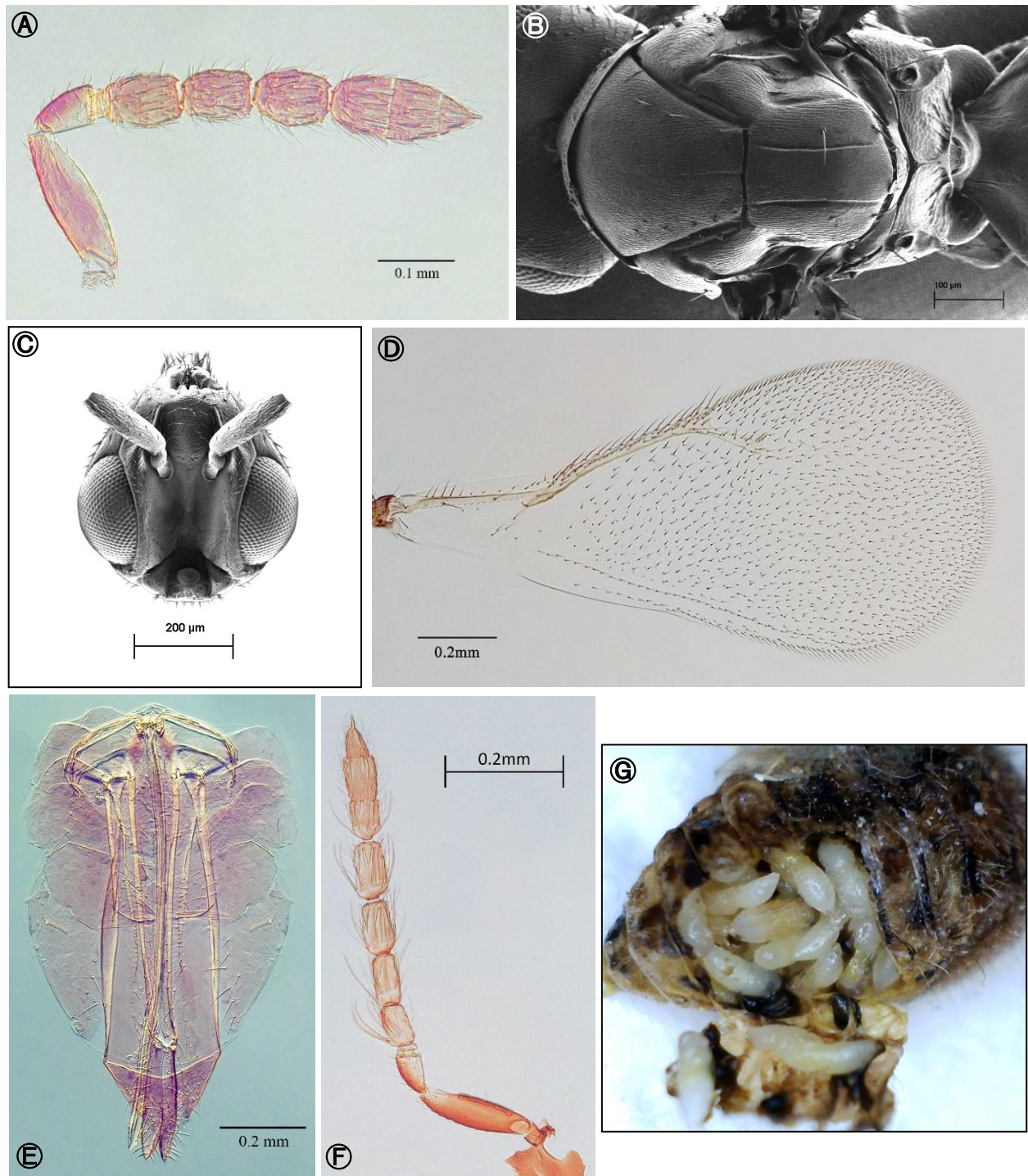


Figure 1. *Baryscapus ecballii* sp. n. **a**) female antenna; **b-c**) female SEM microphotographs: **b**) dorsal view showing mesonotum (with mesoscutum and scutellum) followed by propodeum; **c**) head, frontal view; **d**) female forewing; **e**) female genitalia; **f**) male antenna; **g**) dissected pupa of *Henosepilachna elaterii* containing gregarious *B. ecballii* sp. n. pupae.

Head (figure 1c) not quite as broad as mesoscutum, in dorsal view 2.25-2.3× as broad as long, temples about 0.2× eye length, POL 2.4-2.6 OOL, OOL about 2× OD; head in front view 1.2× as broad as high, malar space 0.7× height of eye and slightly greater than width of mouth opening, clypeus with two rounded teeth; malar sulcus in lateral view moderately curved with a very small suborbital fossa.

Antenna (figure 1a) inserted above level of lower eye margin, equidistant from anterior margin of clypeus and anterior ocellus; scape 0.9× length of eye, reaching only lower edge of anterior ocellus; pedicel plus flagellum slightly longer than breadth of head; pedicel 2× as long as broad; funicle almost filiform, F1 as long as and slightly broader than pedicel and about 1.6× as long as broad, F2 slightly shorter than F1 about 1.4× as long as broad, F3 similar to F2, clava as long as F2+F3, 2.8× as long as broad with apical spine about 0.4× length of C3.

Mesosoma 1.45× as long as broad. Mesoscutum 0.7× as broad as long with very fine engraved reticulation with only some of areoles longer than broad; median line distinct; a row of 3 or 4 adnotaular setae on each side and usually 1 or 2 additional setae internal to this row. Scutellum moderately convex, 1.2-1.3× as broad as long; submedian lines weakly divergent posteriorly, medially equidistant from each other and sublateral lines and enclosing a space about 2.5× as long as broad; setae of similar length, the anterior pair just behind the middle, occasionally a short extra seta present on one side. Propodeum medially slightly longer than dorsellum; spiracles a little separated from posterior margin of metanotum; callus with 3-5 setae.

Forewing (figure 1d) with length costal cell: marginal vein: stigmal vein as 33:31:14, postmarginal vein a stub; submarginal vein with 3 or 4 dorsal setae, marginal vein with 9-13 setae on anterior margin; stigmal vein basally thin, gradually expanding into a poorly differentiated stigma; basal cell bare, basal vein with 3 or 4 setae; speculum moderately large, closed below; apical margin ciliate.

Gaster lanceolate (figure 1e), including ovipositor sheath 1.9-2.3× as long as broad, about 1.2× as long as rest of body; last tergite somewhat longer than broad; ovipositor sheath projecting by about 0.3× length of last tergite; tip of hypopygium at just before mid-gaster.

Male

Differs from female as follows. Scape only about 3.6× as long as broad with a ventral plaque on about 0.8× its length; pedicel plus flagellum about 1.15× breadth of head; flagellum of 4 funicle segments plus 3-segmented clava, all of similar breadth, slightly broader than pedicel; F1 quadrate, F2 about 1.2× as long as broad, F3 and F4 only slightly longer than broad, clava about 3.4× as long as broad; funicle segments each with a subbasal whorl of setae (figure 1f), the setae reaching beyond the apex of the segment that bears them. Gaster obovate, as long as head plus mesosoma.

Type material

Holotype: ♀, Malta, Haż-Żebbuġ, reared from pupa of *Henosepilachna elaterii* collected 26.vi.2015 on *Ecbal-*

lium elaterium, emerged 1-7.vii.2015 (leg. T. Cassar).

Allotype: ♂, same data as holotype.

Paratypes: 8 ♀♀, 2 ♂♂, same data as holotype; Haż-Żebbuġ, 15.vi.2017, 14 ♂♂ and 25 ♀♀, reared from pupa of *Henosepilachna elaterii* collected 15.vi.2017 on *Ecballium elaterium*, emerged 17-25.vii.2017 (leg. T. Cassar).

The holotype, allotype and three paratypes (2 ♀♀, 1 ♂) will be deposited in the Natural History Museum, London (BMNH). Remaining paratypes are in the authors' collections.

Additional material

Around 120 specimens (both males and females; generally around 70% of emerged parasitoids are always females) emerged between 1-7.vii.2015 from 6 pupae of *Henosepilachna elaterii* collected on *Ecballium elaterium* on 26.vi.2015 at Haż-Żebbuġ.

Etymology

Named after the generic name of the host-plant of *H. elaterii*.

Comments

The new species runs readily to *Baryscapus* in Graham's (1991) key to genera of Tetrastichinae, having an almost entirely black body (but see below) with strong metallic blue-green reflections, curved malar sulcus, convex mesosternum, indications of a second row of adnotaular setae on each side, completely exposed propodeal spiracular peritreme and male antennal funicle segments with whorls of comparatively short setae. Within *Baryscapus* it runs to the *evonymellae* species-group (Graham, 1991) with the submedian scutellar lines enclosing a space at least 2.5× as long as broad, the lines about equidistant from each other and the sublateral lines, thorax hardly broader than high, relatively elongated funicle segments, and the forewing without an unpigmented spot between parastigma and marginal vein.

In Graham's (1991) key to females of European *Baryscapus*, *B. ecbalii* runs no further than couplet 30 where it agrees with neither alternative, the funicle proximally being hardly broader than the pedicel but not broadening distad, the submarginal vein bearing 3 or more dorsal setae and the tibiae being entirely pale. It appears to have most affinity with *Baryscapus evonymellae* (Bouche) and the two species in couplet 32, but it differs from them, and apparently from all other described European species of *Baryscapus*, in having yellow marks below the antennal toruli and laterally on the dorsellum.

Biology

The specimens reared in 2015 were collected from pupae of *H. elaterii* (Coccinellidae) found on *E. elaterium* (Squirting Cucumber). As in all Epilachninae, *H. elaterii*, is a plant feeder. It is a serious pest of crop plants damaging economically important cucurbitaceous plants. Preferred host-plants of *H. elaterii* include various crops such as cucumber (*Cucumis* spp.), watermelon (*Citrullus lanatus*), colocynth (*Citrullus colocynthis*)

and, calabash vine (*Lagenaria siceraria*) among others (El-Abdin and Siragelnour, 1991). The beetle damages foliage, with larvae and adults consuming either the upper or lower epidermal layers of leaves, resulting in scraped and exposed tissue (Akandeh and Shishehbor, 2011). This kills leaves and may seriously affect crop yields and the overall health of the host-plant.

Gregarious parasitism was obvious in the species, with numerous specimens of *Baryscapus* found within each pupa (figure 1g) of *H. elaterii*. In fact, the highest number of adults which successfully emerged from an *H. elaterii* pupa was 42 and the lowest was 16. However, not all parasitized *H. elaterii* pupae were fully developed. One host larva which was parasitized had not fully pupated; rather than allowing the host to pupate, parasitization led to the larval exoskeleton being completely hardened, the larva turning from yellowish-brown to a brownish-grey coloration. Sixteen parasitoids emerged from this particular specimen and a much more developed pupa proved to be equally parasitized with again 16 adults emerging from it.

Some reproductive behaviour was observed under magnification. Male adults were observed pursuing females very closely and at speed while at the same time producing rapid wingbeats. Females would either continuously try to escape the male - after which the male ceased to give chase - or stop and allow the male to mount.

Coccinellidae are attacked by Tetrastichinae of the genera *Aprostocetus* Westwood, *Oomyzus* Rondani, *Quadrastichus* Girault, *Tetrastichus* Haliday and *Sigmoepilachna* Khan, Agnihotri et Sushil (known from a single Indian species, an egg parasitoid of *Epilachna*) (Noyes, 2016), but parasitism of a ladybird by *Baryscapus* is rare. The only species previously recorded in this connection is *Baryscapus thanasimi* (Ashmead), a Nearctic species reported to be parasitic upon Cleridae (Coleoptera) that was originally described in *Tetrastichus* but placed in *Baryscapus* by La Salle (1994). In addition to Cleridae, it is listed as also attacking *Chilocorus stigma* (Say) (Coleoptera Coccinellidae) by Noyes (2016), quoting Peck (1963) as the source, but no reference to this host is made by Krombein *et al.* (1979). *B. thanasimi* is described as having yellowish white scape and tegulae, funicle segments less than twice as long as broad, clava 'thickened' and abdomen wider but no longer than thorax. It is certainly different from *B. ecballii*.

Acknowledgements

We would like to thank James Camilleri of the Department of Metallurgy and Materials Engineering, University of Malta, for all his help in taking the SEM photographs of the new species of *Baryscapus*.

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Received May 14, 2018. Accepted October 1, 2018.